THE PHYSIOLOGICAL ACTION OF ALCOHOL.

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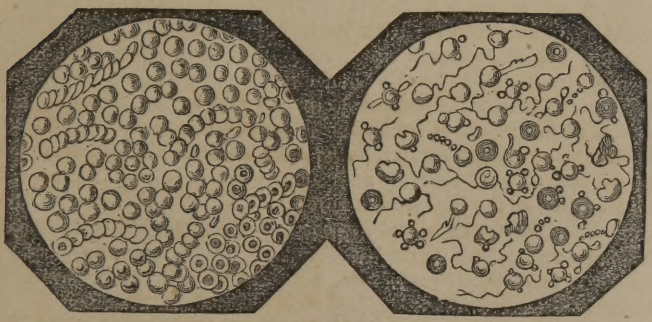

FIG. 1.—Blood corpuscles; some with darkened centres, owing to the focal point at which they are seen; others in rolls, indicative of slight inflammation.

FIG. 2.—Blood corpuscles altered from their natural shape by the action of sherry wine or diluted alcohol (250 diameters).

IT is now more than thirty years since the composition of alcohol, and its effects upon the human body, attracted the attention of the physiologist and the chemist. Since that time many important works have been written upon the subject, and numberless experiments have been made by scientific men whose names rank high in the annals of chemistry and physiology, not only in our own country, but also in France, Sweden, Germany, and America. It is not my intention to give you a *resumé* of all that has been written on this topic, for that would occupy too much of your time; nay, even to give you a history of alcohol would necessitate the delivery of many lectures. But I wish to draw your attention to the last verdict of science on this important inquiry, including a notice of *some* of the recent experiments performed by men eminent in my own profession.

I do not desire my remarks to partake of the character of a *teetotal lecture*, but rather of a scientific inquiry into the mode of action of alcohol when introduced into the tissues of the body. Nevertheless, I would not have it understood that I, in any way, disparage the moral efforts made by total abstainers who, years ago, amid good report and evil report, stood in the front of the battle to war against the multitude of evils occasioned by strong drink;—all praise be due to them for their noble and self-denying exertions! I consider that man who has a longing desire for strong drinks, arising from his having indulged in their daily use, and can, by an effort of his will, restrain his appetite from such indulgence, "is greater than he who taketh a city." Had it not been for the successful labors of these moral giants in the great cause of Temperance, presenting to the world in their own personal experiences many new and astounding physiological facts, men of science would, probably, never have had their attention drawn to the topic.

The alcohol question having lately been discussed in our medical journals, I shall endeavor to condense into one lecture some of the most important points developed. This is the more needful, since, owing to the wide-spread literature of Temperance in the present day, one portion of the public is beginning to read and judge for itself, while the other naturally turns to the medical profession for information on the subject. I need scarcely add, that in the House of Commons, in the Mansion, on the Bench as at the Bar, and even within the walls of our Universities, Colleges, and Medical Schools, men are found devoting their time and talents to do battle against the giant Strong-drink, as the cause of so much pauperism, crime, misery, insanity, and social degradation.*

The most important question to be answered is—WHAT IS ALCOHOL? or, specially, *Is it food*, or *poison*, or *medicine*, or *a luxury?* Under the term ALCOHOLIC, I include *all* intoxicating drinks, because it is on account of the alcohol chiefly, if not wholly, that such drinks are used. The principal intoxicating beverages of this country are brandy, whisky, rum, gin, wines, ale, porter, perry, and cider, which are more or less intoxicating according to their amount of alcohol. It may not be uninteresting to know the percentage of alcohol contained in liquors which it is so fashionable for adult persons of all ages to indulge in. According to Professor Brande——

Pale Ale contains....	5 to 9 per cent.	Gin.....	51·60 per cent.
Ale.....	6½ "	Brandy.....	53·39 "
Cider.....	7 "	Rum.....	53·68 "
Port Wine.....	23 "	Whisky.....	53·90 "

* The author begs to acknowledge the assistance he has derived from the valuable writings of the following scientific authorities: Dr. F. R. Lees, F.S.A., Edinburgh; Dr. T. K. Chambers; Dr. Brinton, F.R.S.; Dr. E. Smith, F.R.S.; Dr. Carpenter, F.R.S.; Dr. Markham; Dr. Figg; H. Mudge, Esq., M.R.C.S.; T. D. Fletcher, Esq., M.R.C.S.; R. Dunn, Esq., F.R.C.S.

These liquors are all more or less diluted by the publican, and often colored, drugged, and adulterated to suit the taste of purchasers or increase the profit of the dealer.

ALCOHOL, in chemical language, is a hydrated oxide of ethyle. Its composition is $C_4 H_6 O_2$ (or $C_4 H_5 O + HO$). It is nowhere to be found in any product of nature, was never itself created by God, but is essentially an artificial thing, prepared by man through the destructive process of fermentation. It will be my aim to show that *perfect* health can only be obtained by total abstinence from all intoxicating drinks, since alcohol deranges the natural functions and produces a morbid condition of the tissues.

IS ALCOHOL A POISON? Every writer on toxicology has classified alcohol as a narcotic or a narcotico-acrid poison. For proof, I refer you to the works of Professor Orfila, Dr. Pereira, Professor Christison, Dr. Taylor, and other eminent authorities. Alcohol is a powerful narcotic poison; and if a large dose be taken, no antidote is known to its effects. But you may inquire—

WHAT IS A POISON? The most comprehensive definition which has been suggested is this: "A poison is a substance which, when taken internally, is *capable* of destroying life without acting mechanically on the system."* It may be said that no one drinks pure alcohol. Quite true: you might as well try to drink a glass full of sulphuric acid. It would instantly burn the mouth and tongue, and destroy the tissues. So, you will understand, when we speak of the action of alcohol, we mean alcohol *as it is taken*, largely diluted with water or mixed with other ingredients. According to the amount of alcohol contained in the liquor, in the same proportion will be its degree of action on the body—other conditions remaining the same. A small quantity of pure alcohol injected into the veins of an animal would cause immediate death, showing alcohol to be a dangerous and deadly poison. Cases are on record of persons who, drinking off at a draught from a quarter of a pint to a quart of ardent spirit, have died *immediately* afterward. The poison having been absorbed from the stomach, mixed with the blood, carried to the heart, and propelled to the brain, the nervous centres become at once paralyzed, and the heart ceases to beat.

Some of my audience may be led to exclaim—"WHAT! ALCOHOL A POISON? Is a man who has been out at a convivial party, and, on returning home, performs certain wonderful gyrations with his legs, poisoned? Is a gentleman who has partaken of a few glasses of wine after an excellent dinner, and sung the praises of the 'Good Rhine wine' and its deep, deep draught,' in a state of incipient poisoning? Can alcohol in its various forms, when *moderately* taken, be anything

* This will include *physiological injury of a kind tending* to that result. A certain quantity can *kill*,—a lesser will *injure*.

but a blessing to man; affording him *such comfort* when he is unhappy, or worn out with the cares of business? Does it not strengthen him when he is weak; cheer him when he is cast down; encourage him when his spirits fail; warm him when he is cold; and sustain him under all his trials and sufferings when broken-hearted with worldly troubles? Is not alcohol the 'rosy god' to whom all do honor at almost every epoch of man's existence? When man is born into the world a little chubby, ruddy, struggling young squeaker, is not his health drunk by the doctor, nurse, and half-wondering, heart-palpitating papa; lest, if this particular part of the ceremony be omitted, the nurse should hint that the young infant's hair would never grow? When he is christened, do not the godfathers and godmothers drink the health of the young innocent, and pledge themselves to everything? When he is married, is not the greatest honor done to the bride and groom by drinking to their health and happiness? When he is buried, is not the same drinking ceremony gone through, only with silent tongues and longer faces; and are not even the very coachmen treated with a *little drop*, just to drink to the happiness of the deceased? Can any one in his senses make *me* believe that the universal custom of drinking alcoholic liquors is a universal evil, when everybody takes them, at every place and on every occasion? Is everybody in the world, more or less, shortening his existence by taking into his system one of the most delightful and bewitching of drinks? It is all nonsense to call alcohol a poison. I won't believe it—so here's your health!"

Yet modern science, with a voice of deep, sepulchral tone, still persists: "IT IS A POISON;" and many a breaking heart, on leaving this world, has sobbed out its last farewell, re-echoing these words!

As, to follow me in some of my observations, it will be necessary that my audience should be somewhat acquainted with the structure and functions of the body, especially with the process of digestion and absorption, I will endeavor to be as explicit as possible.

Every kind of substance employed by man as food consists of sugar, starch, oil, and glutinous matters, mingled together in various proportions; these are designed for the support of the animal frame. The glutinous principles of food—*fibrine*, *albumen*, and *caseine*—are employed to build up the structure; while the *oil*, *starch*, and *sugar* are chiefly used to generate heat in the body.

The first step of the digestive process is the breaking up of the food in the mouth by means of the jaws and teeth. On this being done, the SALIVA, a viscid liquid, is poured into the mouth from the salivary glands, and as it mixes with the food, it performs a very important part in the operation of digestion, rendering the starch of the food soluble, and gradually changing it into a sort of sugar, after which the other principles become more miscible with it. Nearly a pint of saliva

is furnished every twenty-four hours for the use of an adult. When the food has been masticated and mixed with the saliva, it is then passed into the stomach, where it is acted upon by a juice secreted by the filaments of that organ, and poured into the stomach in large quantities whenever food comes in contact with its mucous coats. It consists of a dilute acid known to the chemists as HYDROCHLORIC ACID, composed of hydrogen and chlorine, united together in certain definite proportions. The gastric juice contains also a peculiar organic-ferment or decomposing substance, containing nitrogen—something of the nature of yeast—termed *pepsine*, which is easily soluble in the acid just named. That gastric juice acts as a simple chemical solvent, is proved by the fact that, after death, it has been known to dissolve the stomach itself.

In order that the food passed down into the stomach should be thoroughly acted upon, the gastric juice selects, principally, the albuminous portions, reducing them to a substance technically called *albuminose;* this, with the starchy and oily portions, becomes a common pultaceous mass, called CHYME. The starch, sugar, and fat are not so much acted upon in the stomach as they are in the intestines, where they meet with the pancreatic juice and the bile, and are there thoroughly digested. ALBUMEN, the plastic element that builds up the tissues, requires twenty times its quantity of the gastric juice to dissolve it. Man consumes three to four ounces of albumen daily, so that his stomach will have to provide from sixty to eighty ounces (three or four pints) of this solvent.

It is an error to suppose that, after a good dinner, a glass of spirits or beer assists digestion; or that any liquor containing alcohol—even bitter beer—can in any way assist digestion. Mix some bread and meat with gastric juice; place them in a phial, and keep that phial in a sand-bath at the slow heat of 98 degrees, occasionally shaking briskly the contents to imitate the motion of the stomach; you will find, after six or eight hours, the whole contents blended into one pultaceous mass. If to another phial of food and gastric juice, treated in the same way, I add a glass of pale ale or a quantity of alcohol, at the end of seven or eight hours, or even some days, the food is scarcely acted upon at all. This is a fact; and if you are led to ask—Why? I answer, because alcohol has the peculiar power of chemically affecting or decomposing the gastric juice by precipitating one of its principal constituents, viz., PEPSINE, rendering its solvent properties much less efficacious. Hence alcohol can not be considered either as food or as a solvent for food. Not as the latter certainly, for it refuses to act with the gastric juice.

"It is a remarkable fact," says Dr. Dundas Thompson, "that alcohol, when added to the digestive fluid, produces a white precipitate, so that the fluid is no longer capable of digesting animal or vegetable matter." "The use of alcoholic stimulants," say Drs. Todd and Bowman,

"retards digestion by coagulating the *pepsine*, an essential element of the gastric juice, and thereby interfering with its action. Were it not that wine and spirits are rapidly absorbed, the introduction of these into the stomach, in any quantity, would be a complete bar to the digestion of food, as the *pepsine* would be precipitated from the solution as quickly as it was formed by the stomach." Spirit, in any quantity, as a dietary adjunct, is pernicious on account of its antiseptic qualities, which resist the digestion of food by the absorption of water from its particles, in direct antagonism to chemical operation. Dr. Figg says: "If a pound of raw beef, cut square, be immersed for twelve hours in a pint of proof spirit, it will be found, when weighed again, to have lost four ounces three drachms; if the surface be examined with a microscope, it will be found covered with a profusion of acicular tufts of a coffee-brown color, and the whole structure considerably condensed. This loss of substance and condensation of tissue are attributable to the removal of water, and the brown deposit to the caustic influence of the alcohol on the albuminous element of the beef." If, after dinner, two or three glasses of spirits were drunk, the gastric juice would be neutralized, and the albuminous portions of the meat charred and solidified, so that the pylorus would turn back the undigested mass, thereby protracting its stay in the stomach beyond the natural time; or should any of the half-digested food force its way into the intestines, it would act as an irritant of their delicate tissues, and probably, to get rid of it, would set up a brisk diarrhœa.

Dr. Figg, in speaking of some of the operatives living in the vicinity of the Canongate of Edinburgh, says: "The workpeople of various large establishments dined at mid-day on Saturday, and, receiving their wages immediately after, at once adjourned to the various public-houses, where they indulged in a state of intoxication, which, fed by occasional libations, continued frequently till noon on the following day, when, exhaustion of funds prohibiting fresh supplies, the collapse of intoxication succeeded. In this crisis, requested to prescribe for the nausea and its concomitant symptoms, a mustard emetic brought up the substance of the dinner of the previous day, with little or no change save that produced by mastication. To each of two mastiffs, six months old, five ounces of cold roast mutton, cut into squares, were given, the meat being passed into the œsophagus without contact with the teeth. An elastic catheter was then passed into the stomach of one of them, and one ounce and a quarter of proof spirit injected. After some hours had elapsed, both animals were killed. In the case where the meat had been administered by itself, it had disappeared. In the other, the pieces were as angular as when swallowed."

Side by side with these stern realities, let me contrast the experiments of Dr. Beaumont on St. Martin, the great criterion in all physiological disputation on the digestive system: "Experiment 42.—Eight

A.M.—St. Martin breakfasted on three hard-boiled eggs, pancakes, and coffee. At a quarter-past ten, *no part of the breakfast remained in the stomach.* At eleven, ate two roasted eggs and three ripe apples; at a quarter-past twelve, *no vestige.* At two P.M., same day, roasted pig and vegetables; at half-past four, all gone."

It may be argued on the other side, that so small a quantity as a glass or two of beer or wine daily could produce little or no injury, and that the cases related only show the effects of alcohol when taken in large doses; in fact, that alcoholic beverages, when taken in moderation, assist digestion rather than otherwise. I have often heard it asserted by patients that they could not eat their dinner at all until they had had a glass of beer; but after having imbibed a certain quantity of this "*nourishing*" element, they could then take their dinner with much pleasure and benefit.

Doubtless, if no person took more alcoholic liquor than a glass of beer, such a procedure would be ruinous to all teetotal societies, as well as to a good many brewers; for, according to the calculation of Mr. Gladstone, every ADULT MALE in England consumes not far short of six hundred quarts per year. But the term MODERATION, with regard to alcoholic drinks, defies all definition. What may seem a moderate dose for one person, may nearly poison another. A patient of mine, some years ago, asked me if he might have "a sup of ale to steady his stomach and revive him a little." I replied, he might have "a little." He drank a *gallon* of ale next day; and then said, "From lately being so abstemious, it got into my head a bit!"

However, let us see how far a glass of beer is beneficial. It is *supposed* to stimulate the stomach to an increased secretion of the gastric juice, and thereby assist digestion. If this were so, two glasses of beer should cause the stomach to secrete double the quantity. But this is not so. Nature secretes this powerful fluid to effect the solution of *solids*, not liquids. Dr. Beaumont completely demonstrated this fact in one of his valuable experiments, where the fluid which exuded from the coats of St. Martin's stomach on the contact of alcohol, was *merely an enlarged supply of its natural mucus* (with the evident end of sheathing its delicate structure from the destructive action of the poison). To expect the stomach to secrete gastric juice at *all* times, on the contact of alcohol, is an expectation not in accordance with the laws of nature. The only influence of alcohol on the stomach is that of a simple *irritant.* The Russian practice of passing round a small liqueur-glass of undiluted spirits to each guest just before going to dinner, simply inflames or irritates the mucous membrane of the stomach, inducing the person to eat more than is beneficial, and robbing him of the power to digest the food when he has swallowed it. He suffers from two evils—too much food, and less ability to digest it: nay, from two others besides—dyspepsia and a doctor's bill! Such a powerful irri-

tant to the mucous membrane of the stomach does alcoholic liquor in any shape become, that I have had many patients who have been obliged to desist from its use altogether. I have known a single glass of brandy or whisky occasion in some persons the most obstinate nausea and vomiting for days after, leaving the stomach quite unable to bear the least quantity of solid food, and with difficulty the blandest of drinks.

Alcohol, taken in small quantities or largely diluted as in the form of beer, causes the stomach gradually to lose its tone, and makes it dependent upon artificial stimulus. Atony, or want of tone of the stomach, gradually supervenes, and incurable disorder of health results. If you habitually give an organ assistance, it will at last come to trust to that assistance, and refuse to work without such aid being rendered. So, if a person stimulates his stomach habitually with a glass of beer at his dinner, that stomach will very soon become languid, and object to work without its beer. Persons so accustomed to the artificial stimulus cry out, "I *can't* eat my dinner without my beer!" because the stomach says, "I *won't* go without." A little wholesome abstinence and starvation would soon bring it round.

Dr. Hammond practically demonstrates by his experiments, that alcohol taken with ordinary diet *has the same injurious effects as the excessive use of food;* in other words, that its use is qualitative abuse, as gluttony is quantitative intemperance. If it be as admitted, even by our opponents, that alcohol thickens the circulating stream, retards excretion, arrests hunger, and *so* makes the present supply of food last longer, some of its present and ultimate results *must* be evil. The occasional use as described may apparently have some advantage, but the continual use must be allowed to be an unmitigated mischief. The testimony of two millions of total abstainers in England shows that health is *improved* by the disuse of such poisonous liquids.

When alcohol is taken into the stomach as a portion of the ordinary drink, it readily passes into the blood by a simple act of *endosmodic absorption*, through the coats of the blood-vessels, rather than by the special absorbent process in the intestines. Received into the blood, it is carried with the stream to the heart and lungs, and then (such part as is not eliminated by the breath) back to the heart, to be pumped by that organ to all parts of the body. Alcohol thus passes on with the arterial blood, carrying into every capillary its own peculiar influence.

The blood consists of a fluid termed *liquor sanguinis*, and the corpuscles or blood discs, the latter floating in the fluid element. It is well known to microscopic observers of the blood, how speedily elements of diet, medicinal substances, and poisons are found in the *liquor sanguinis*, and how the corpuscles of the blood become affected by these various agents. By experimenting on the blood with sherry wine or diluted alcohol, the blood disc becomes altered in shape and

throws out matter from its interior; minute molecular particles also fringe the circumference. Some of these molecules separate from the blood discs and float about in the fluid; others elongate into tails, which move about with a tremulous motion. When the *liquor sanguinis* becomes surcharged with alcohol, either by imbibition of small quantities daily, or by a large quantity suddenly, the blood-corpuscles swimming in it not only become affected, but also the *liquor sanguinis* itself suffers deterioration. An unwholesome or deficient diet gives rise to blood diseases, such as gout, scurvy, fever, diarrhœa, etc.; for substances taken as food impart their qualities to the fluid of the blood, and also to the corpuscles. The day after a debauch, the parched tongue, nausea, shivering, and feverish symptoms, all testify, not only that the blood has become poisoned or deteriorated, but that it has circulated such poison to every organ of the body. Prof. Schultz states, "that alcohol stimulates the blood discs to an increased and unnatural contraction, which hurries them on to the last stage of development—that is, induces their premature decay and death. The coloring matter is dissolved out of them, and the pale discs lose all their vitality; whence less oxygen can be absorbed and less carbon carried out." It is not difficult to recognize the pale anæmic condition of the daily spirit-drinker. The experiments of Dr. Böcker on the blood, with spirits, wine, and beer, the results attested by the microscope, and the researches of Dr. Virchow, the celebrated pathologist, concur in proving that alcohol poisons the blood, and arrests the development, as well as hastens the decay, of the red corpuscles. Dr. Böcker noticed the alterations undergone by the blood of habitual alcohol drinkers *as yet in good health*, viz., a partial loss of power to become red by exposure to the air, in consequence of the loss of vitality in a portion of the blood discs. This loss of vitality manifests itself by the formation of black specks (oil) in the discs (an observation confirmed by Lallemand), and then by their conversion into round pale globules which, in all cases of disease (*i. e.*, of diminished vitality), are found in excess in the blood. *This devitalized condition of the nutritive fluid is probably the first step to the devitalization of the tissue which it feeds.*

We have seen that so soon as the alcohol has been absorbed into the blood, it is carried by the tide to the heart, the inner surface of which organ, disturbed by the presence of the alcohol, pumps away so much the faster to get rid of the intruder.

The heart is, in fact, a wonderful pump, that gives seventy or eighty strokes per minute, of every hour, day, and night perpetually, and were it to cease beating for a single minute, life would cease. Now it sounds to reason, that if an artificial stimulus be taken into the blood, which urges on the action of the pump to extra work, that extra work must all the sooner wear out the machinery. Let a person take a glass of brandy, and in a few minutes his pulse would rise ten or more beats

per minute. Should a dose of alcoholic drink be taken daily, the heart will very often become hypertrophied, or enlarged throughout. Indeed, it is painful to witness how *many* persons are actually laboring under disease of the heart, owing chiefly to the use of these liquors.

There is no kind of tissue, whether healthy or morbid, that may not undergo fatty degeneration; and there is no organic disease so troublesome to the medical man, or so difficult of cure. It is a well-known fact, that the *fibro-albuminous* substance called "flesh" undergoes, under certain circumstances, a transformation into fat. In involuntary muscle this degeneration begins with the transverse striæ, and more especially at the circumferance of the fasciculus. As this extends inward, minute molecules of fat occupy the position of the striæ, and at length obliterate them, so that the normal structure of the muscle disappears. When cut into, a greasy stain is left upon the knife. The heart, in persons affected with fatty degeneration, loses the firm muscular appearance which characterizes it in health, and presents a pale yellowish buff color, either throughout or in special parts. To show the frequency of this peculiar disease, I quote the statement of Dr. Ogle, that in 143 post-mortems, he found one hundred persons whose hearts were thus affected, as tested in each case by a microscopic examination. Dr. King Chambers justly observes, "that the most active renewal of the body possible is *health;* the cessation of renewal is *death;* the arrest of renewal is *disease.*" Now, since the direct action of alcohol is to arrest the renewal of tissue, how could any well-informed medical man recommend, as a *vital tonic*, an agent which has the property of arresting the metamorphosis of tissue? Again, says Dr. Chambers, "in *death*, decomposition goes on to its end; there is no renewal of the organism, and the living form disappears. In disease, decomposition goes on, but there is an arrest of renewal, and the decayed tissues are not thrown off by the newly-formed substance; they become *de*generate, not *re*generate—a kind of death in life." Now if, by the aid of the microscope, we examine a very fine section of muscle taken from a person in good health, we find the muscles firm, elastic, and of a bright red color, made up of parallel fibres, with beautiful crossings or striæ; but if we similarly examine the muscle of a man who leads an idle, sedentary life, and indulges in intoxicating drinks, we detect, at once, a pale, flabby, inelastic oily appearance. Alcoholic narcotization appears to produce this peculiar condition of the tissues *more than any other agent with which we are acquainted.* "Three quarters of the chronic illnesses which the medical man has to treat," says Dr. Chambers, "are occasioned by this disease." The eminent French analytical chemist, Lecanu, found as much as 117 parts of fat in 1,000 parts of a drunkard's blood, the highest estimate of the quantity in health being 8½ parts, while the ordinary quantity is not more than two or three parts; so that the blood of the drunkard

contains forty times in excess of the ordinary quantity. No reflecting mind, at all acquainted with Temperance literature, would wonder at the large percentage of this peculiar disease, when it recalls the fact that during the last year, in the United Kingdom, there were consumed 28,500,000 gallons of whisky, 6,000,000 gallons of wine, and 666,000,000 gallons of ale and porter ! ! !

As a very suddenly fatal case of this disease occurred not long ago—one of a like character with half a dozen more which I have witnessed during the last few years—I may mention it. The person was of middle age, rather stout, of exceedingly quiet habits, never appearing to be in a hurry about anything, taking only moderate exercise, but never seen walking fast or exerting himself. He had, however, contracted the bad habit of taking a small glass of whisky three or four times a day, yet never appearing drunk or in the least excited. He was the popular *picture* of good health, and had scarcely ever had a day's illness, but sometimes complained of a fullness at the chest and slight beating of the heart. One day, after having partaken of his dinner, drank a glass of ale, and smoked his pipe as usual, on rising up to go to his business, he suddenly dropped down on the floor, and died immediately. On making the post-mortem examination, the brain seemed healthy, so did the heart, lungs, liver, and other viscera. The man had died, apparently, without the slightest indication of organic disease, or of any lesion to account for so sudden a catastrophe. On making thin sections of the heart, liver, and kidneys, and placing them under the microscope, the mystery of his death was immediately revealed, for every organ subjected to microscopic analysis exemplified the slow, structural lesions of fatty degeneration. The fibres of the heart, a powerful muscle, had become so enfeebled and degenerated by the internal deposit of oil globules, that it had suddenly, and spasmodically ceased to act. Had the man been a pure water-drinker, such a suddenly fatal result could hardly have happened.

It is the misfortune of medical men to have *scores of patients in a year* laboring under some of the protean forms of fatty degeneration, who would never require the doctor's assistance if they could only forego the daily use of small quantities of alcohol. This agrees with a broad experience. As Dr. Lees observes:

"That alcohol should contribute to the fattening process under certain conditions, and produce in drinkers fatty degeneration of the blood, follows as a matter of course, since, on the one hand, we have an agent that *retains waste* matter by lowering the nutritive and excretory functions, and on the other, a *direct poisoner* of the vesicles of the vital stream."

Dr. T. K. Chambers also remarks:

"Alcohol is really the most ungenerous diet there is. It impoverishes the blood, and there is no surer road to that degeneration of muscular fibre so much to be feared; and in heart disease it is more especially hurtful, by quickening the beat, causing capillary congestion and irregular circulation, and thus mechanically inducing dilatation

of the cavities. Let the alcoholic drink be limited. * * * For a great many instances, the quantity may be very shortly written down—0."

The organs most affected by alcohol when *taken into the stomach*—the organs in which it is found most to accumulate—are, according to the eminent French physiologists, Professors Lallemand and Perrin, the *liver* and the substance of the *brain*. "If in the blood it is represented by 1·0; in the brain it is 1·34; in the liver 1·48." "But if alcohol be *injected into the veins*, it spreads to all the tissues, accumulates most largely in the brain; being in the liver as 1·75; in cerebral matter, 3·0." So that these observers come to the old conclusion, that the selective power of alcohol for the brain is nearly twice as great as that for the liver, and nearly three times as that for other tissues; and that death by alcoholic poisoning is due, primarily, to its special action on the nervous centres. When a person dies suddenly from the effects of a large dose of alcohol, it is from sudden shock to the nervous system. There are numerous such cases. Dr. Lees says: "On 19th September, 1863, two Rochdale men made a bet as to which would drink the most *rum*. In a quarter of an hour they had drunk fifteen pennyworth each. One fell down dead a few moments afterward, and the other became insensible." I knew myself the case of an engine-driver to a luggage train who, for a wager, drank off, within ten minutes, a pint of *rum*. In a few minutes afterward he was in strong convulsions, and then became insensible. Medical aid being at hand, a great portion of the rum was brought up from his stomach; but his life, for a week after, was despaired of.

Now the brain is divided into (1.) the *cerebrum*, or brain proper, composed of many convolutions of grey matter, with which man perceives, remembers, judges, wills, and dictates movements; (2.) the *sensorium*, which is a mass of white vesicular nerve-substance, situated near the cerebrum, or upper brain. Its particular office is to register all the impressions received from the special organs of sense—the eye, ear, nose, tongue, and skin. Beneath the sensorium, and posteriorly, is the *cerebellum*, which regulates and equilibrates locomotion; and inferior to this comes the *medulla oblongata*, which excites and directs respiration. Thus all creatures having a cerebrum are capable of performing some kind of intellectual operation.

Habits of intoxication, or the continued use of alcoholic drinks short of this stage, as shown on a post-mortem examination of the brain, produce a congested condition of its minute capillary vessels, indicating an amount of pressure which materially interferes with healthy function. This congestion, seen, on cutting through the brain, as minute blood spots, often gives rise to epilepsy and apoplexy.

The blood, so becoming impaired by the habitual use of intoxicating beverages, is no longer able to sustain the brain in a healthy condition; and beneath the *pia mater*, a membrane surrounding the convolutions

of the brain, is nearly always found an effusion of a milky fluid, indicative of congestion and stimulation, which accounts in part for the mental incapacity and disorder of the drunkard.

I will not trouble you with a *description* of the diseases to which the brain is liable from habits of intoxication, such as inflammation of its membranes, arrest of development, idiotcy, *delirium tremens*, insanity, paralysis, etc.; but draw your attention to the effects of alcohol on the *cerebrum* or brain proper, the most important part of my subject. Recalling the fact, that it is in this organ alcohol most largely accumulates, the disturbed mental functions which follow drinking can be easily explained. I would first refer you to the experiments made by Dr. Edward Smith, upon himself and others, with reference to the *psychological* action of a small dose of diluted alcohol:

"In from three to seven minutes the mind was disturbed. Consciousness, the power of fixing the attention, the perception of light, and, we believe, of sound also, and the power of directing and co-ordinating the muscles, were lessened; while there was a very marked, peculiar, continuous, thrilling, not unpleasant sensation, passing down through the whole system, during thirty minutes. After this period the effect diminished, as shown by increased consciousness and the perception of light, *as if a veil had fallen from the eyes; nevertheless, the last power to be completely regained was consciousness.*

"Spirits made us very hilarious and talkative in ten minutes, and during twenty to twenty-five; so much so, that my friend was altogether a king. But as minutes flew away, so did our joyousness; and, little by little, we lessened our garrulity and felt less happy, until at length, *having gone down by degrees*, we remained silent, almost morose, and extremely miserable. Then, indeed, we felt the horrors and the sorrows of the drunkard's lot, and saw, *with a clearness which can only be perceived by such experience, how certain it is that he must again drain the intoxicating cup.*

"In addition, *every mental perception was darkened;* and the dreaminess, which is not an unpleasant feature of it, is a condition in which neither thought nor imagination acquires power."

It appears from the experience of Mr. Fletcher, who has paid much attention to the cases of drunkards, from the remarks of Mr. Dunn, in his "Medical Psychology," and from observations of my own, that there is some analogy between our physical and psychical natures; for as the physical part of us, when its power is at a low ebb, becomes susceptible of morbid influences which, in full vigor, would pass over it without effect, so when the psychical (synonymous with the *moral*) part of the brain has its healthy function disturbed and deranged by the introduction of a morbid poison like alcohol, the individual so circumstanced sinks low in depravity, and *becomes the helpless subject of the forces of evil*, which are powerless against a nature free from the morbid influences of alcohol.

Different persons are affected in different ways by the same poison. Indulgence in alcoholic drinks may act upon one or more of the cerebral organs; and, as its necessary consequence, the manifestations of functional disturbance will follow in such of the mental powers as these organs subserve. If the indulgence be continued, then, either from de-

ranged nutrition or organic lesion, manifestations formerly developed only during a fit of intoxication may become *permanent*, and terminate in insanity or dipsomania. M. Flourens first pointed out the fact that certain morbific agents, when introduced into the current of the circulation, tend to act *primarily* and *specially* on one nervous centre in preference to that of another, by virtue of some special elective affinity between such morbific agents and certain ganglia. Thus, in the tottering gait of the tipsy man, we see the influence of alcohol upon the functions of the *cerebellum* in the impairment of its power of co-ordinating the muscles.*

Certain writers on diseases of the mind make especial allusion to that form of insanity termed DIPSOMANIA, in which a person has an unquenchable thirst for alcoholic drinks,—a tendency as decidedly maniacal as that of *homicidal mania;* or the uncontrollable desire to burn, termed *pyromania;* or to steal, called *kleptomania.*

The different tendencies of homicidal mania in different individuals are often only nursed into action when the current of the blood has been poisoned with alcohol. I had a case of a person who, whenever his brain was so excited, told me that he experienced a most uncontrollable desire to kill or injure some one; so much so, that he could at times hardly restrain himself from the action, and was obliged to refrain from all stimulants, lest, in an unlucky moment, he might commit himself. Townley, who murdered the young lady of his affections, for which he was sentenced to be imprisoned in a lunatic asylum for life, *poisoned his brain with brandy* and soda-water before he committed the rash act. The brandy stimulated into action certain portions of the brain, which acquired such a power as to subjugate his will, and hurry him to the performance of a frightful deed, opposed alike to his better judgment and his ordinary desires.

Wilkes Booth, the cowardly murderer of the late President of the United States, when he saw his helpless victim in the box at the theatre, had not the cruelty to strike the blow; his better feelings overcame him, and trembling with suppressed agony at the thought of becoming an assassin, he rushed into the nearest restaurant, crying out, "Brandy! brandy! brandy!" Then, gulping down the hellish draught, it instantly poisoned his blood, fired up his brain, transformed his whole nature into that of a raging fiend; and, in this remorseless condition, he

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* I remember well the case of a gentleman whose legs would get drunk two hours before his brain became affected. I have often seen him taken home by persons whose heads were giddy with drink, but whose legs were firm, while *his* brain appeared perfectly sober, though he had no power of locomotion. He was often far more sober in his conversation than the companions who carried him home; yet, if left alone, he would suddenly fall to the ground, his legs useless and paralyzed. When at the public-house he was often asked to have "just another glass," he would answer, "I will, if you will see me safe home afterward."

shot down that noble-hearted President, the nation's great hope, the people's best friend. Then, what killed the President of the United States? I answer, "Brandy! brandy! brandy!" †

As to *pyromania*, some years ago I knew a laboring man in a country village who, whenever he had had a few glasses of ale at the public-house, would chuckle with delight at the thought of firing certain gentlemen's stacks. Yet, when his brain was free from the poison, a quieter, better disposed man could not be. Unfortunately he became addicted to habits of intoxication; and one night, under alcoholic excitement, fired some stacks belonging to his employers, for which he was sentenced for fifteen years to a penal settlement, where his brain would never again be alcoholically excited.

Next I will give an example of *kleptomania*. I knew, many years ago, a very clever, industrious, and talented young man, who told me that whenever he had been drinking, he could hardly withstand the temptation of stealing anything that came in his way; but that these feelings never troubled him at other times. One afternoon, after he had been indulging with his fellow-workmen in drink, his will unfortunately was overpowered, and he took from the mansion where he was working some articles of worth, for which he was accused, and afterwards sentenced to a term of imprisonment. When set at liberty he had the good fortune to be placed among some kind-hearted persons, vulgarly called *teetotallers;* and, from conscientious motives, signed the PLEDGE, now above twenty years ago. From that time to the present moment he has never experienced the over-mastering desire which so often beset him in his drinking days—to take that which was not his own. Moreover, no pretext on earth could now entice him to taste of any liquor containing alcohol, feeling that, under its influence, he might again fall its victim. He holds an influential position in the town where he resides.

I have known some ladies of good position in society who, after a dinner or supper party, and after having taken sundry glasses of wine, could not withstand the temptation of taking home any little article not their own, when the opportunity offered; and who, in their sober moments, have returned them as if taken by mistake. We have many instances recorded in our police reports of gentlemen of position, under

† Since the delivery of this lecture, another lamentable illustration has become public, in the person of Dr. Pritchard of Glasgow, since executed for poisoning his wife and mother-in-law. In his two confessions he states as follows: "1. Mrs. Pritchard was much better immediately after her mother's death, but subsequently became exhausted from want of sleep. I accounted for this by the shock produced by her mother's death; and, hardly knowing how to act, at her own request I gave her chloroform. It was about midnight; Mary M'Leod was in the room, and in an evil moment—being, besides, *somewhat excited by whisky*—I yielded to the temptation to give her sufficient to cause death; *which I did.* 2. I can assign no motive for the conduct which actuated me beyond a species of terrible madness, and *the use of* ARDENT SPIRITS.

the influence of drink, committing thefts of the most paltry articles afterward returned to the owners by their friends, which can only be accounted for, psychologically, by the fact that the *will* had been for the time overpowered by the influence of alcohol.

That alcohol, whether taken in large or small doses, immediately disturbs the natural functions of the mind and body, is now conceded by the most eminent physiologists. Dr. Brinton says:

"Mental acuteness, accuracy of perception, and delicacy of the senses are all so far opposed by the action of alcohol, as that the maximum efforts of each are *incompatible* with the ingestion of any moderate quantity of fermented liquid. Indeed, there is scarcely any calling which demands skillful and exact effort of mind and body, or which requires the balanced exercise of many faculties, that does not illustrate this rule. The mathematician, the gambler, the metaphysician, the billiard-player, the author, the artist, the physician, would, if they could analyze their experience aright, generally concur in the statement, that *a single glass will often suffice to take*, so to speak, *the edge off both mind and body*, and to reduce their capacity to something below what is relatively their perfection of work."

Not long ago, a railway train was driven carelessly into one of the principal London stations, running into another train, killing, by the collision, six or seven persons, and injuring many others. From the evidence at the inquest, it appeared that the guard was reckoned sober, *only he had had two glasses of ale* with a friend at a previous station. Now, reasoning psychologically, these two glasses of beer had probably been instrumental in *taking off the edge* from his perceptions and prudence, and producing a carelessness or boldness of action which would not have occurred under the cooling, temperate influence of a beverage free from alcohol. Many persons have admitted to me that they were not the same after taking even one glass of ale or wine that they were before; and could not *thoroughly* trust themselves after one glass.

Evidently, then, alcohol causes a person to commit certain acts in spite of himself, and in the face of his better judgment. Professors Lallemand and Perrin, in their remarkable researches, have proved that alcohol, introduced into the system, produces in *all* persons an intoxication that is marked by a progressive series of functional disturbances and alterations, the intensity of which corresponds with the quantity of alcohol taken. *Alcohol is no respecter of person.* If taken it will as certainly operate on the queen upon the throne, as the beggar in squalid misery; on the minister of God's holy word, as the vilest reprobate; on the judge upon the bench, as the criminal at the bar; on the soldier who fights for his country, as on the humblest member of the peace society. None who partakes of it can withstand its *essential* influences, though he may exemplify its power by varying actions and behavior.

A "Natural History of Drunkards" might divide them into two general classes: those who take drink because they *like* it, and those

who take drink because they *can not help* it. The latter condition too often supervenes upon the former.

Mr. Fletcher, on inquiring into the causes of drunkenness, found that the largest number of drunkards traced their commencement to *social* drinking, and to drinking to *drown care*. A smaller number could not say *why* they took drink; but acknowledged that, having once begun, they could not stop. The same writer seems to think that there must be some constitutional difference of a physical nature, independent of the moral condition, which explains the desire for stimulants in some people, and the indifference to them in others. Drunkenness does not always accompany moral degeneracy. Some men are neither moral in their habits nor scrupulous in their associations, who live in the society of those who drink, and yet themselves *do not drink*. There are others, again, whose moral character is good, whose associations are good, in whom, nevertheless, there is *a tendency to drink*, sometimes heroically vanquished, at others tyrannously asserting its power, overmastering the most solemn resolutions, and driving the victim into excesses to which he looks back with loathing and shame. There are others who take their regular quantity of spirits every night, and go to bed drunk at a certain hour, as methodically as clock-work, who, nevertheless, are up in the morning, and fit for work at the usual time, as regular as can be. I have, again, known many persons who probably have never partaken of alcoholic drinks more than a few times in a long life,—nor could they be induced ever to take them regularly,—to whom drink, of course, never was a "temptation." I have met with many persons in *middle life* who have never tasted alcohol in any shape, nor could they be persuaded to do so. I think in these unfrequent cases, there must be some constitutional peculiarity of a *physical nature*, for I have noticed the same antipathy to alcoholic drinks in their children. On the other hand, I have been a painful witness to the dreadful effects of strong drink in some families, where the parents have died the most horrible of deaths; where not the parents, but every member of the family amounting to four or five persons, have come to an untimely end.

Drunken habits manifest themselves in families, often through bad example and bad training; and yet I have known the propensity for drink developed in families where the training was *not* faulty, where the example has been most praiseworthy, and where the education had been of a highly religious character.

Some writers consider that all persons who get drunk are mad for the time, and that all habitual drunkards are dipsomaniacs. Certainly, numbers of persons get drunk every night, who never could be said to be mad, for they are happy, quiet, harmless, and go on in their nightly fuddlings for years; though there are others who, when intoxicated, are *really* mad, and conduct themselves more like fiends

than human beings. I have seen a man, peaceable when sober, kick down a kind, beseeching, loving wife, with as much vengeance as he would kick a reptile out of his way. I have seen him thrash his poor little helpless children, and tear from their half-naked bodies their bits of clothes, to pawn for more drink. Indeed, you can not take up a newspaper but your blood almost curdles at reading accounts of murders, manslaughters, suicides, and numberless other crimes, committed under the influence of strong drink.

There is another class of persons whose characteristics a few glasses of wine only serve to bring out. With others, again, no sooner does the brain become excited by even a moderate dose of alcohol, than they commit all sorts of foolish actions, being perfectly reckless of consequences. I saw a young gentleman, very early one morning, sitting upon a door-step, quite exhausted from a daring feat he had just been performing. On his knee were two strong door-knockers, three bell-pulls, and part of an area railing, all of which he had taken into safe custody, thinking himself as valiant as an officer who had taken a trophy from the enemy.

Sometimes this tendency shows itself in a harmless or an absurd generosity. I have known persons under alcoholic excitement take a pleasure in standing champagne or brandy-and-water for a navvy, a policeman, or an organ-grinder; and sometimes, not too particular, for the company all round. But whether it is mere "love of approbation," or pure benevolence, which is acting, may be questioned.

There is one phenomenon observed, not only in dipsomania, but in many other cases where the brain becomes poisoned with drink—I mean an utter want of *truthfulness*. The circulation of alcohol in the brain appears to evoke the most brilliant talents—for lying. I have heard persons, under its baneful influence, tell the biggest lies—just like truth! I knew a gentleman, exceedingly well read up in the Crimean war, but occasionally given to drink, who met another young man who had just returned from the scene of action, and who, indeed, had been engaged in one of the principal battles. The conversation naturally turning upon the war, the gentleman who had never been out of England gave such a vivid, truthlike account of the whole struggle, narrating the exploits he had gone through, the dangers *he* had braved, and how his life had only just been saved by a brave companion who carried him off the field, quite exhausted, from the bayonets of the Russians,—that the young stranger seized the gentleman's hand, and, while sobs choked his voice, exclaimed, "Are you ———, the man I saved? Here? Alive, whom I thought was dead! Give me your hand—I'm overjoyed! How wonderful to meet here to-night! Waiter, bring in another bottle of wine!"

I knew many years ago, a gentleman who, when on board a vessel anchored in a foreign port, saw a little cabin-boy fall overboard and

carried away by the tide. The gentleman, who was very courageous and an excellent swimmer, immediately pulled off some of his clothes, jumped into the water, and swam after the half-drowned cabin-boy. After much difficulty he succeeded in saving the poor boy's life and getting him on shore. The first time I heard him relate this story of his swimming capabilities, soon after the accident, he said that he swam down the river about a quarter of a mile, which no doubt was near the truth. Judge of my surprise, then, on hearing the gentleman give an account of his daring feat *after a few glasses of wine*, when he stated that he had swum at least three miles!

There is another singular phenomenon often exemplified in the character of those who get intoxicated, namely, a horror of returning home, an overwhelming desire to go wandering aimlessly about. One patient, as soon as his brain became affected by a certain quantity of alcohol, would wander alone for hours; sometimes walk for miles in the country, and at last fall quite exhausted for want of proper food and rest. I have known others wander about through the town for a whole night, until the effects of the alcohol had become expended, when they would sneak home quite ashamed and disgusted with themselves. Let me recapitulate the conclusions to which we have come.

1. Where the body is free from disease, and the brain is healthy, the psychical or moral portion will have full power to keep in check, or overbalance, the passions for evil.

2. When the brain has become poisoned with alcohol, which, by a peculiar affinity, deranges certain special ganglia of the brain, the resisting power of the *will* for the time being becomes impaired or weakened, and the man is then powerless against temptations. Hence what remorse of mind, what struggles of conscience, what bitterness of heart, what tears of repentance are too often the experience and the penalty of that man in his sober senses who has indulged in an evening's revelry or a night's debauch!

3. If the brain be kept continually under the influence of alcohol, the power over the will becomes lost, and the patient relapses into a confirmed dipsomaniac—a pitiable spectacle of drunken insanity

It now remains for me to show, by veritable extracts from the works of acknowledged teachers of chemistry, medicine, and physiology, not only that alcohol in any shape is unnecessary to the healthy performance of the various functions, but that its introduction into the healthy body inflicts a positive injury.

Professor Lehmann, in his "Physiological Chemistry," says: "We can not believe that alcohol, theine, etc., which produce such powerful reactions on the nervous system, belong to the class of substances *capable* of contributing toward the maintenance of the vital functions."

Professor Moleschott, of Erlangen, says: "Alcohol does not effect any direct restitution, *nor deserve the name of an alimentary principle.*"

Dr. Brinton, physician to St. Thomas' Hospital, in his "Introduction to Dietetics," says: "Careful observation leaves little doubt that a *moderate dose of beer* or wine would, in most cases, *at once diminish the maximum weight* which a healthy person could lift, to something below his *teetotal standard*."

He also refers to the chamois hunters of the Bavarian Alps, who to secure their own safety and endurance, while tracking their game from one mountain peak or precipice to another, *rigidly abstain*, for their life is dependent upon a quick eye, a steady hand, and a strong foot. The self-same principle is adopted temporarily by our trainers, runners, prize-fighters, and boat-racers.

Had Deerfoot, the celebrated runner, indulged in sundry glasses of bitter beer or porter, or *nourishing* old port, his strength, fleetness, and endurance would soon have passed away.

Tom Sayers, the "champion of England," could never have stood up and fought a much taller man than himself for nearly two hours, saying nothing of the pummeling and constant hammering he received, as with a sledge hammer, for that period, had he not been prepared for such a warfare on total-abstinence training. A gentleman said to this renowned hero of the prize ring, "Well, Tom, of course in training you must take a deal of nourishment, such as beefsteaks, Barclay's stout, or pale ale?" "I'll tell you what it is, sir," answered master Thomas, "I'm no teetotaler, and in my time have drunk a good deal more than is good for me; but when I've any *business* to do, there's *nothing like water* and the dumb-bells." * Heenan, his American antagonist, is systematically a teetotaler, and so is the champion wrestler of Westmoreland. Johnson, of Manchester, the modern Samson, lost his power as an acrobat through the moderate use of beer, but it has returned to him as an abstainer, so that he can now do the most amazing feats.

Our volunteers find out by experience that nothing gives steadiness of nerve so well as water-drinking. At the rifle contest at Kidderminster, in 1861, a teetotaler of eighteen years' standing won the first prize silver cup, against a grocer, a brewer, a publican, and a solicitor. In another class, the silver cup was won by Mr. Pember, who had been a teetotaler all his life. During the rifle shooting for prizes, at the usually quiet town of Gainsburgh, the first prize, a silver cup, value £10, and a second prize, value £3, were won by a teetotaler, who was, in fact, the only *abstainer* in the list of competitors. The greatest cricketer in the world is also a teetotaler.†

Teetotalism was practiced by the ancients in the early days of the world's history, and is no new theory. Milo, the Italian Samson, was a teetotaler; the Bible Samson was a total abstainer. "Never," says

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* Yet drink has slain even him, ere he reached forty years!

† *Vide* Dr. Lees' works, and his articles re-printed from *Meliora*.

good Bishop Hall, "did wine make so strong a champion as water did here."

Dr. T. K. Chambers, Hon. Physician to the Prince of Wales, says:

"It is clear that we must cease to regard alcohol as *in any sense* an *aliment*, inasmuch as it goes out as it went in, and does not, so far as we know, leave any of its substance behind it. It remains for some hours in the body, and exerts in that time a powerful influence. What is that influence, and over what tissues is it exerted? '*A stimulant to the nervous system.*' On the nervous system, doubtless, and *especially on the mental functions* of the nervous system, every experimenter, from the first patriarch downward, would agree that its prime action is evident. But what *is* a stimulant? It is usually held to be something which spurs on an animal operated upon to a more vigorous performance of its duties. It seems very doubtful if, on the healthy nervous system, this is ever the effect of alcohol, even in the most moderate doses, and for the shortest periods of time."

When alcohol is taken, "there is noticed also an increased rapidity of pulse; but that can not be regarded as an evidence even of locally augmented vital action, for, of all patients, those specially exhibit it who have the weakest hearts, and are most enfeebled by disease. A diminution of force is quite consistent with augmented quickness of motion. Physiologists have always taught, as confirmed by all experiments, that large doses of alcohol immediately, and small doses after a time, depress the nervous centres; the primary action is anæsthetic—a *diminution of vitality in the nervous system.*"

In Dr. Smith's experiments alcohol was proved to lessen consciousness and sensibility to light and touch. *Surely this is very unlike a spur to extra exertion!* What then becomes of the popular as well as medical notion, that alcohol *strengthens* the nerves?

The intellect is said to flash forth brighter with wine; but analyze the wit of a convivial party the morning after, when the mind is clear and the head cool, and you will find it isn't half so witty as you thought.

We now come to those most conclusive experiments on dogs and men made by some eminent Frenchmen, with a most admirable apparatus, and published at Paris in October, 1860. The experiments on alcohol of the distinguished physiologists, Professors Lallemand and Perrin, assisted by the chemist Duroy, are, in fact, a sequel to a series which they had been instituting as to the peculiar operation of chloroform and anæsthetic agents in general. Dr. Rudolf Masing had applied a more certain test for detecting alcohol and choloform in the blood and tissues than was previously used, and adopting this, they establish the fact, that when choloform is inbreathed it is received in substance into the blood and conveyed to the brain, in which it may be detected after death; but whenever inhalation is suspended, the chloroform is quickly exhaled by the breath as chloroform, *unoxydized.* Turning to *alcohol*, they prove its absorption into the blood and its subsequent passage to the nervous centres. Next they seek for it in the breath. The test was the following: A tube holding a solution of bichromate of potass and sulphuric acid was placed at the end of the breathing apparatus. This is a red liquor, which by action of alcohol changes to an emerald green, the chromic acid becoming green oxide

of chromium. They found that the breath of people who had taken *no* alcohol left the solution unchanged in color. The inference was plain, that the alteration was due either to alcohol or its derivatives, aldehyde or acetic acid, in the breath. They next carefully analyzed the blood of animals to which alcohol had been given, in order to find *aldehyde:* not a trace could ever be discovered.* They then subjected to the test the blood and brain of animals to which alcohol had been administered, and the results agreed with the proofs furnished by the distillation of alcohol itself from those portions of the body.

Having thus satisfied themselves of the trustworthiness of the new test, they proceed to inquire, "*What becomes of alcohol in the body?*" The re-agent being again prepared, the *breath* of the drinker was passed through the liquor, when it changed from *red* to *green*, thus furnishing a standard of comparison. In one experiment, where a man concludes his breakfast at 10½ with a litre of light red wine (1 7-10ths of a pint), his breath at 12 and 1 o'clock P.M. converts an English cubic inch of the test liquid in two minutes; at 2 P.M., in four minutes; at 4 o'clock, in ten minutes; at 5 P.M., in fifteen minutes; at 6, but a partial change; at 7 P.M., none at all. Thus gradually but surely is the poison cast out of the system.

From *urine* subjected to the same test, similar results were obtained. After the use of a bottle of weak wine, the kidneys would secrete alcohol for the long period of fourteen hours. The *skin* is also proved to be an organ for the elimination of the poison. Even an intoxicated dog (an animal not remarkable for its perspiration) was found to exhale alcohol, when placed in a glass case with its head out.

These physiologists completely vindicate the old definitions of food and poison given by Temperance teachers. They show most lucidly, for example, that moderate excitement is *simply a lower degree of the same kind* of abnormal stimulation which is known as *inebriation*, and that alcohol never *gives* force, but merely wastes it.

"These facts establish, from a physiological point of view, *a line of demarkation* between *alcohol* and *foods*. Foods restore the forces, without the organism betraying, by disturbed functions or by outward agitation, the labor of reparation, *which is accomplished silently in the woof of the tissues*. Alcohol, on the other hand, immediately *provokes*, even in a moderate dose, an excitement which extends through the entire economy." The following is a part of the *resumé* of their conclusions:

A. Alcohol ingested into the stomach, applied to the skin, or introduced as a vapor into the lungs, is absorbed by the veins, and carried by the blood into all the tissues.

B. The ingestion of alcohol produces upon animals an intoxication that is marked by a *progressive series of functional disturbances and alterations*, the intensity of which corresponds with the *quantity* of alcohol absorbed.

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* Dr. Lees, in the *Medical Journal* for November 4th, 1865, points out the value of the negative proof, that *no trace of any of the derivatives of alcohol* is found. In other words, no ashes, no fire; no shells, no eggs. Dr. Anstie and others quietly ignore this important fact.

C. It manifests itself at first by a general excitement; but, by and by, the respiration and circulation are relaxed, and the temperature lowered.

D. *Muscular power is weakened and extinguished;* beginning at the extremities.

J. *Alcoholized blood contains, during life and after death, a great number of free fatty globules, visible even to the naked eye.*

K. The pathological alterations are: very vivid inflammation of the mucous membrane of the stomach; the accumulation of the blood in the right chamber of the heart and the large veins; congestion of the *meninges*, and especially of the lungs.

M. Alcohol, taken by the stomach, *accumulates* in the liver and substance of the brain; if in the blood it is as 1·0; in the brain, it is 1·34; in the liver, 1·48.

P. Death by alcoholic poisoning is due primarily to its special action upon the nervous centres.

R. *We never found, in either the blood or tissues, any of the derivatives of alcohol.*

T. Alcohol is rejected from the vital economy by divers systems of *elimination*, by the lungs, the skin, and the kidneys.

U. *These organs are found to eliminate alcohol after the ingestion of doses very small.**

V. The elimination lasts many hours, *even after an ingestion very moderate.* The kidneys continue the longest to reject.

X. *Aldehyde* [a derivative of alcohol], *when* introduced into the stomach, *is* readily found in the blood.

Z. Alcohol has the same action, and produces the same effects, upon men and upon the lower animals."

The conclusions to which these experiments have been conducted, may be adopted as axioms by the Temperance advocates, and have been named by Dr. Lees the "SEVEN PILLARS OF TEMPERANCE."

1. Alcohol is not food.

2. Alcohol is a special modifier of the nervous system. It acts, in a feeble dose, as an *excitant;* in a larger, as a *stupefiant.*

3. *Alcohol is never transformed, never destroyed, in the organism.*

4. Alcohol accumulates, by a sort of elective affinity, in the brain and in the liver.

5. Alcohol is *eliminated* from the organism in totality and in nature. The channels of elimination are: the lungs, the skin, and, above all, the kidneys.

6. Alcohol has a pathogenetic influence, material and direct, upon the development of many functional disturbances and organic alterations of brain, liver, and kidneys.

7. Spirituous drinks owe to the alcohol they contain their common properties and the specialty of their effects. The use of fermented and distilled liquids is often [always?] noxious: it should be always very restrained; *it should never be tolerated, save in exceptional circumstances.*

During the last few years the *British Medical Journal* has liberally opened its pages for the discussion of the question, "IS ALCOHOL FOOD OR PHYSIC?" The distinguished editor, Dr. Markham, thus sums up the discussion, so far as it has gone:

"We have no wish hastily to speak on this important matter, but we are in conscience bound boldly to declare the logical and inevitable conclusions, as they seem to *us*, to which a scientific view of the subject *forces* us.

"The grand practical conclusions are these: 1. That alcohol is *not* food; and that, being simply a stimulant of the nervous system, its use is hurtful to the body of a

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* Dr. Anstie and others have asserted, contrary to this plain statement, that *only excessive doses* were used!

healthy man. 2. That if its imbibition *be* of service, it is so only to man in an abnormal condition; and that our duty, as men of medicine, is to endeavor to define what those particular abnormal states are in which alcohol is serviceable. 3. That ordinary social indulgence in alcoholic drinks, for society's sake, is, medically speaking, a very unphysiological and prejudicial proceeding."

In conclusion, you may ask,—"What is the remedy for this crying evil of our land?" An answer would occupy many lectures, and many points of ingenious disputation might arise, not readily to be determined. The scientific character of this lecture precludes me from indulging in any oratorical display, and prevents me from appealing to your moral feelings on this grave question. I will add only this: No man liveth for himself, but every man liveth, by his example, for good or for evil; and I can not but believe that a TEETOTAL CHRISTIANITY is the *special* need of our age.

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